

FOWLER (Geo. R.)

ON ELBOW-JOINT FRACTURES

BEING A

CLINICAL STUDY OF TWENTY CASES OF FRACTURE AT
THE LOWER END OF THE HUMERUS INVOLVING
OR APPROXIMATING THE ELBOW JOINT.

BY

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ELBOW-JOINT FRACTURES.

The interest awakened in the subject of fractures involving or approximating the elbow joint, and most especially the consideration of the circumstances leading to the production of deformities following such fractures, as presented in a lecture before this Society by my friend, Dr. Oscar H. Allis of Philadelphia, are very decided evidence of the importance of the subject. The recent paper by Dr. John A. Ray, the subject of this evening's discussion, dealing as it does chiefly with fractures in the neighborhood of, or involving the elbow joint, resulting from railroad accidents, does not, in my opinion, represent the matter in the light most valuable to the general surgical practitioner. In view of the fact that upward of twenty cases of fracture in this region, the greater part of them due to falls either upon the hand or elbow, have come under my observation and treatment, I am impressed with the belief that a careful study of the clinical histories of such a series of cases would be of importance. I have therefore tabulated these cases, and will attempt to elucidate some points suggested by a review of the table.

The first point which I shall take up is the age of the pa-

TABULATED SYNOPSIS OF TWENTY CASES OF FRACTURE AT THE LOWER END OF THE HUMERUS.

BY GEORGE R. FOWLER, M. D., BROOKLYN, N. Y.

NO.	NAME.	AGE.	DATE OF ACCIDENT.	CHARACTER OF LESION.	CHARACTER OF ACCIDENT.	DRESSING.	PASSIVE BEGUN. MOTION	FREQUENCY OF PASSIVE MOTION.	PASSIVE MOTION DISCONTINUED.	RESULT AS REGARDS MOTION.	RESULT AS REGARDS DEFORMITY.	DISPLACEMENT OF CONDYLE.
1	W. B.	6	Nov. 7, 1872.	Fracture of external condyle.	Fall upon hand.	Plaster Paris and pillow; arm at right angle.	4th day.	Every 24 hours.	20th day.	Every motion perfect.	Angular projection of forearm lost.	External condyle $\frac{1}{2}$ inch below internal.
2	J. S.	24	Nov. 12, 1872.	Fracture of external condyle with dislocation of radius and ulna backward.	Fall upon hand.	Softened sole-leather splints (lateral), sling; arm at right angle.	3d day.	Every 24 hours.	25th day.	Every motion perfect.	The angle of the forearm upon the arm absent.	External condyle $\frac{1}{2}$ inch below line.
3	A. S.	40	May 5, 1872.	Fracture of external condyle; rupture of annular ligament and dislocation of radius.	Fall down cellar, striking on hand.	Starch dressing, soft pasteboard splint; arm at right angle.	3d day.	Every 24 hours.	28th day.	Pronation slightly impaired; otherwise every motion normal.	No appreciable deformity.	Not ascertained.
4	L. O.	9	May 13, 1873.	Separation of epiphysis.	Fall down stairs.	Plaster Paris; arm at right angle.	14th day.	Every 24 hours.	29th day.	Extension perfect. Flexion limited.	Outward angle of forearm destroyed.	Not ascertained.
5	J. D.	14	May 16, 1874.	Fracture internal condyle.	Fall with arm under body.	Arm rested upon pillow; water dressing.	10th day.	Daily.	25th day.	Every motion perfect.	Both arms alike.	Not ascertained.
6	F. H.	9	Jan. 14, 1875.	Fracture internal condyle.	Fall upon ice.	Sole-leather splints and sling; arm at right angle.	3d day.	Daily.	30th day.	Every motion perfect.	Outward angle as compared to other arm, destroyed.	Internal condyle $\frac{1}{2}$ inch above line.
7	W. D.	4	Apr. 22, 1875.	Fracture internal condyle.	Fall down stairs.	Plaster Paris and pillow rest; arm at right angle.	14th day.	Daily.	27th day.	Every motion perfect.	Outward angle slightly altered.	Internal condyle $\frac{1}{2}$ inch above line.
8	J. W.	3½	Mar. 14, 1876.	Fracture external condyle.	Fall from cradle.	Lateral sole-leather splint upon outside; arm at right angle.	5th day.	Daily.	28th day.	Extension perfect; in flexion places tips of fingers upon shoulder.	Outward angle destroyed.	External condyle below line.
9	D. P.	10	May 17, 1876.	Fracture coronoid process; dislocation humerus forward.	Fall from velocipede.	Two lateral sole-leather splints; arm at right angle.	2d day.	Daily.	18th day.	Every motion perfect.	No deformity.	None.
10	A. S.	4½	Jan. 10, 1877.	Fracture internal condyle.	Fall upon elbow while flexed.	Two lateral sole-leather splints; arm at right angle.	4th day.	Daily.	14th day.	Every motion perfect.	Arm, including forearm perfectly straight.	Internal condyle elevated $\frac{1}{2}$ inch.

11	W. W.	10	Jan. 26, 1878.	Fracture external condyle; dislocation of radius.	Fall down embankment.	Two lateral sole-leather splints.	3d day.	Daily, under nitrous oxide for first week. Afterward ev'ry 2 or 3 days.	24th day.	Every motion perfect.	Angular relation of forearm to arm lost.	External condyle $\frac{1}{2}$ inch below line.
12	M. A.	5½	Aug. 24, 1878.	Fracture internal condyle.	Fall from curb-stone.	Two lateral sole-leather splints; arm at right angle.	3d day.	Daily first week; afterward every 2 or 3 days.	21st day.	Every motion perfect.	Deformity very slight.	Not ascertained.
13	M. R.	45	Apr. 18, 1878.	Fracture internal condyle.	Fall from step-ladder.	Two lateral sole-leather splints; arm at right angle.	4th day.	Every 2 days.	20th day.	Every motion perfect.	Very slight lessening of angular projection as compared to other arm.	Internal condyle very slightly elevated.
14	C. C.	9	July 27, 1878.	Transverse fracture through trochlea, and longitudinal fracture between condyles.	Fall upon olecranon and posterior surface of ulna with arm at right angle.	Arm at right angle; two lateral sole-leather splints, sling.	5th day.	Daily first 10 days; afterward every 2 days.	27th day.	Perfect motion.	Angular projection of forearm decidedly lost.	Not ascertained.
15	G. T.	7	Apr. 28, 1879.	Fracture internal condyle.	Fall from wagon.	Arm at right angle; softened leather splints.	2d day.	Daily for 8 days; afterward every 2 days.	24th day.	Every motion perfect.	Angular projection of forearm lost.	Internal condyle elevated $\frac{1}{2}$ inch.
16	J. C.	4	Dec. 7, 1878.	Fracture internal condyle.	Fall.	Arm at right angle; softened sole-leather splints, sling.	3d day.	Daily first week; occasionally subsequently.	22d day.	Every motion perfect.	Angular projection of forearm lessened.	Not ascertained.
17	H. G.	20	Dec. 8, 1879.	Fracture internal condyle.	Fall.	Arm at right angle; sole-leather splints, sling.	4th day.	Daily until end of 2d week; every 2 days subsequently.	29th day.	Every motion perfect.	Angular projection of forearm lessened.	Not ascertained.
18	H. M.	22	Nov. 28, 1879.	Transverse fracture through trochlea; left arm.	Machinery accident; patient carried around pulley shaft.	In the treatment of a fracture of the shaft of humerus, in middle third, the arm was securely fastened to body, with intervening gutta percha splints, including anterior and posterior surfaces of arm, being reflected under axilla and over chest (Richardson's). Deformity at elbow joint reduced and forearm placed in sling at right angle, and resting against anterior chest wall.	7th day.	Daily, by simply taking forearm from sling but not disturbing dressing on arm.	30th day.	Flexion perfect; extension slightly less than normal.	Angular projection of forearm lost.	None.
19	"	"	"	Fracture internal condyle; right arm.	"	Fracture of surgical neck of humerus in this arm required same splint as other arm. The forearm, however, was placed in an easy position and rested upon a pillow, and allowed to project forward at a right angle to anterior surface of body. Patient chose this position as it allowed him to turn the leaves of a book placed upon a small stand before him.	7th day.	Daily.	30th day.	Flexion and extension perfect.	No deformity.	None.
20	F. M.	14	Nov. 1, 1879.	Fracture internal condyle.	Fall with arm partly flexed.	Sole-leather lateral splints; arm nearly in full extension.	6th day.	Daily.	14th day. Patient ran away.	Flexion 112° Extension 135°	Deformity due to loss of motion.	Internal condyle elevated $\frac{1}{2}$ inch.

tients. Most of my cases occurred in children, or during the age of recklessness. It is noteworthy that during this age so many fractures of one condyle alone should occur, separation of the epiphysis being the exception, contrary to what is usually taught and accepted.

Second : character of the accident. As before hinted, the majority of cases of this kind coming under the notice of the general surgical practitioner are the result of falls. Among the cases herewith presented, it will be observed that with the exception of two all were due to falls. When the exact position in which the patients fell could be ascertained, it was noticed that in a fall with the forearm extended, the patient striking upon his hand, a fracture of the external condyle ensued. The reasons for this are obvious: the lower extremity of the radius, adapted as it is for a wide range of usefulness in conjunction with the wrist and hand, offers a broader surface for the reception of the blow, and transmission of the force to the external condyle. A rupture of the annular ligament at the head of the radius, and consequent upward and outward dislocation of this bone, occurred in these cases.

Third : character of the lesion. Contrary to Dr. Ray's experience, the majority of my cases prove to be fractures of the internal condyle. I explain this by the fact that the internal condyle being very prominent is most likely to be injured by a fall occurring with the arm semi-flexed. A glance at the articular surface of the lower extremity of the humerus, will reveal the fact that the greater portion of this surface is situated to the outer side of a line drawn through the middle of, and parallel to, the shaft of the bone. This surface, when in articulation with the ulna, brings that bone more to the inner side of the humerus, and when the joint is caught, while fully extended, between two opposing forces, as, for instance, a railroad buffer accident occurring during an

attempt at coupling cars, the prominent olecranon process of the ulna becomes the point of resistance upon the posterior surface of the arm, while the anterior surface of the lower extremity of the humerus is the point of resistance in front. The result that must almost inevitably follow will be seen at a glance. The sharp and prominent ridge marking the inner limit of the trochlea acts as a guard against the transmission of force through the ulna in that direction; consequently the wedge-shaped head of the latter bone is forced outward, breaking off and carrying with it the outer condyle. It may therefore be rationally expected that accidents of the kind described by Dr. Ray, and which I understand to have occurred mainly in the manner above indicated, will be more likely to result in fracture of the external, than of the internal condyle.

Fourth: dressing. It is now more than fifty years since that astute and far-seeing surgeon, Syme, announced that, in the main, fractures into and about the elbow joint, after reduction, require no dressing beyond a simple roller bandage. This statement is as true to-day as it was fifty years ago, and I am convinced that the more elaborate the dressings applied in these cases, the worse will be the result. As will be seen by referring to my table, dressings of starch and softened pasteboard, softened sole-leather used as lateral supports, and the immovable apparatus of the French (plaster of Paris), were indifferently applied without regard to the location of the fracture, whether of the internal or external condyle, or that of the base of the humerus through the trochlea. In three instances no dressings whatever were applied with direct reference to the fracture at the elbow joint. In one of these, No. 5, the case did not come under my care until several days had elapsed; the intra-articular inflammation was such as to demand cold-water dressings, and the traumatic fever ran so high

that the patient was kept to his bed. It was found that the fractured parts were maintained in sufficiently accurate apposition by resting the arm upon a pillow. In the other two fractures, Cases 18 and 19, the occurrence of other injuries precluded any special dressing to the joint, and they were left in a great measure, so far as dressings were concerned, to take care of themselves. Yet in these instances no evil resulted to the joint, and the patients' interests certainly did not in the least suffer. By referring to these cases it will be seen that one of the arms escaped without any deformity whatever. I attribute this to the fact that the patient's arm was confined to the side in order to immobilize a fracture higher up in the humerus, while the forearm was allowed to rest on a pillow at a right angle to the upper arm and also at a right angle to the anterior surface of the body, the patient in the sitting position. This position was assumed by the patient in order that he might turn the leaves of a book placed on a low table beside him. Both arms being disabled rendered this position necessary in order that he might amuse himself during his long confinement in-doors. The other arm was subjected to the same treatment, so far as the upper arm was concerned, but the forearm not being used for any purpose, was hung in a sling at a right angle, and allowed to rest against the body instead of swinging clear of it, as in the case of the other forearm. In this arm there was some deformity, as will be noticed further on.

Fifth : passive motion. Probably the most interesting question, both to patient and surgeon in connection with this whole subject, is that of passive motion. How soon shall we commence, how often shall we practise, and when shall we discontinue, passive motion? In the light of my own experience, I am inclined to think that the only safe way to escape that which every painstaking and conscien-

tious surgeon dreads next only to the loss of the limb itself, namely, ankylosis, is to move the limb as early as circumstances will allow, as often as is consistent with the amount of inflammation, both extra-articular and intra-articular, and not to abandon it until all motions normal to the joint can be performed without the occurrence of pain. Upon this point I am very positive, and I think that the experience of the majority of surgeons will bear me out in the above advice. The importance of early passive motion in cases of fractures and sprains in the neighborhood of the wrist joint has been urged recently by my friend, Dr. Pilcher, and every argument there made use of finds a ready adaptation to the subject of elbow-joint injuries. To put up a limb in a rigid dressing and maintain it for three or more weeks without attempting to move it, to have no concern as to whether or not the joint is becoming indissolubly welded together in one osseous or fibro-osseous mass, I believe to be a practice fraught with danger to the integrity of the patient's limb, to the surgeon's reputation, and last, but not least in these days of malpractice suits, to the surgeon's pocket.

That the danger of osseous ankylosis is very much overrated, I admit, and I believe for many reasons that it is not as likely to occur in the elbow joint as elsewhere; yet to my mind the dread of fibrous ankylosis is sufficiently great to impel me to make, as early as possible in the case, provision due and ample against such a state of affairs.

It is, in my opinion, the existence of the extra-articular inflammation, with its resultant deposit of organizable plastic material, which gives rise to the mischief where ankylosis results after fractures in this region. If it were possible to have an intracapsular arthritis, pure and simple, and limited as such, I believe that ankylosis of any kind would be a very rare sequel to such an occurrence. But it

is a clinical fact that such an arthritis is an exceedingly exceptional occurrence, following injuries to joints of the character under consideration.

It is, then, to alterations in already existing ligamentous and fibrous structures about the joint, conjoined with the formation of new peri-articular fibrinous bands, that we must look for the chief cause of stiff joints as we occasionally meet them. In my experience, the points where these adventitious bands are most likely to occur, are upon the anterior surface of the joint, beneath and within the sheath of the Biceps tendon, and posteriorly about and within the sheath of the tendinous attachment of the Triceps muscle. I have frequently seen, under an anaesthetic, the hard and rigid outline of the tendon of the Biceps rise prominently into view, with its margins as sharply defined as if they had been laid bare by the dissecting scalpel, during the attempt to make full and complete extension of the forearm in the first or second week after a fracture of the elbow joint. Here full extension and flexion once daily, with a short period of massage, followed by twenty-four hours' rest, and at the end of that time a repetition of the same manœuvres, always resulted in a joint with fully restored powers of motion.

I have found it good practice to grasp the joint firmly with one hand, while making the needed movement of the forearm with the other. This serves the double purpose of steadyng the parts against motion in any other direction than those of flexion and extension, and of giving immediate warning of the disposition to displacement of the fragments.

Sixth: result as regards motion. From what has been already said, it may be easily inferred that early, daily, and sufficiently protracted passive motion in suitable cases, will almost surely lead to a perfect restoration of the joint in all

of its normal movements. Whether the end attained justifies the means employed, is a question between the surgeon and his conscience in each instance; but it seems to me that with anæsthesia, and especially the very safe and sufficiently prolonged anæsthesia of nitrous oxide, there can be no hesitancy as to which course we shall adopt. I would here remark that the only case in which there was any considerable loss of movement of the joint, was one which I saw in consultation, and advised its treatment in the nearly straight position. Had I been aware of the obstinacy of this boy's character, I should never have selected him as the subject for such an experiment. The attempt, in all its details, was a most ignominious failure, and it will be a constant source of regret to me that I involved a brother practitioner, as well as myself, in the odium of having a patient walking about with an arm in such a position, that he cannot, with his finger-tips, touch all of the muco-cutaneous margins in his body, a feat easily accomplished even with the arm ankylosed at a right angle.

Seventh: result as regards function. Dr. Allis has pointed out in an admirable manner, and demonstrated upon his own arm, the subject of an elbow-joint fracture in early life, that although the movements of flexion, extension, supination, and pronation may be present after fractures of the kind under discussion, an important function may be, and actually is, in the vast majority of cases, interfered with or entirely lost, and a deformity of the arm produced. The deformity and loss of function which Dr. Allis has particularly called attention to, consist in an absence of the normal angular projection which the forearm bears to the arm as the patient stands upright, with the upper extremities held in what is known as the anatomical position. This angle, although varying somewhat in differ-

ent persons, is, presumably, present in most individuals, and is the means of the proper exercise of the carrying function, and of preventing whatever is carried in the hand, in the anatomical position above referred to, from interfering with locomotion. The loss of this angle, therefore, necessarily entails a loss of the carrying function and a deformity, and I am pained to record that in the majority of my cases this condition exists. How much the patients are damaged by the loss referred to, I am unable to state, inasmuch as not one of them was aware of the fact until I called attention to it, and none of them have yet hinted at a suit for damages, or even asked me to give them a sufficient sum to enable them to live comfortably the rest of their lives. However, the fact remains that there is positive deformity and loss of function as compared with the sound arm, and it behooves us, as seekers after sound scientific truth, to ask ourselves if this condition is the inevitable result of fractures into or about the elbow joint, and if it is not, then what measures shall we take to prevent it?

In surgical matters, as in other matters in life, the prevention of the accomplishment of a fact depends entirely upon our knowledge of the *modus operandi* of its occurrence, and the causes which lead to its development. The measure of our success, therefore, with our ounce of prevention, will be in direct proportion to the extent of our knowledge above referred to. Dr. Allis has spent a great deal of time and energy in throwing light upon the causes which lead to this deformity and loss of function, and those of us who heard his lecture in this amphitheatre, have, I am sure, profited by his remarks. I would needlessly occupy your time and weary your patience were I to attempt to enumerate the many excellent points made by Dr. Allis. I will refer you, therefore, to the publication of his lecture in the August number of the ANNALS for his views.

In looking over my table, I find that those cases having the least amount of deformity were those that were the least treated. I would desire to call especial attention to the fact that in the case in which no loss of this function, and consequently no deformity, occurred, the arm was not held in a sling. In reflecting upon this fact, it occurred to me that perhaps the sling had something to do with the production of this deformity. This idea was further strengthened by the fact, also observed by Dr. Allis, that in fracture of the external condyle, the condyle is dragged downward in the cases where this deformity is present, and in cases of fracture of the internal condyle, the condyle is forced upward. Assuming that the sling is the cause of the deformity, let us examine into the state of an arm held in a sling, with a movable fragment separated by a solution of continuity from the articular extremity of the humerus, but held loosely attached by ligamentous tissue. As the forearm rests against the front of the body, and is supported by the sling, the upper arm has a natural tendency by its own weight and the action of the external rotator muscles to fall to the side of the body and to rotate outward. As this occurs, the fragment in a fracture of the external condyle is held stationary by the external lateral ligament to which it is attached; the base of the humerus is drawn away from it by the rotation of this bone, and a lowering of the normal relative position of the condyle is the result. In the case of the internal condyle, exactly the opposite occurs; as the humerus is rotated outward, the fragment is forced upward, and the normal symmetry of the articular surface is destroyed. Either of these occurrences, a dragging downward of the external condyle, or a pushing upward of the internal condyle, will inevitably result in a loss of the angle of the forearm with the arm, as well as that of the carrying function.

In view of these facts, I would suggest that cases of fracture, of the variety under consideration, be treated by a roller bandage, retaining the proper relation of the fragments; fastening the arm to the side of the body in a position of easy rotation outward, and allowing the forearm to project in what may be described as the beggar's position. If passive motion is rigidly and conscientiously enforced, it will matter but little whether the arm is semi-flexed or not, but it may be allowed to assume the position, in relation to the arm, most comfortable to the patient.

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